UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/728,343	12/03/2003	Christophe Maleville	4717-5300	8607

28765 7590 04/28/2005

WINSTON & STRAWN LLP
1700 K STREET, N.W.
WASHINGTON, DC 20006

EXAMINER	
PERT, EVAN T	

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 04/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/728,343	MALEVILLE ET AL.
	Examiner	Art Unit
	Evan Pert	2826

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *1203 & 0404*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

2. At page 3, at the last line of the 3rd paragraph, "suing" should read --using--. The sentence ending at the first line of p. 7 is grammatically incomplete. Corrections are required.

3. Applicant's use of "residue" in the claims is unconventional and requires one of skill in the art to look to the written description of the specification to understand that applicant deems "a residue" to mean *a residual topography*, or, equivalently, *a residually projecting surface feature*, such as "collar 9."

Applicant is required to change "residue" to --residually projecting surface feature--, --residual topography--, or an equivalently clarifying term, to overcome this objection, by which the meaning of "residue," as filed, is not altered, but only clarified to be synonymous with "residual topography," or the like.

Claim Objections

4. Claims 1-27 are objected to for the unconventional use of "residue," which is unnecessarily confusing. The claims indicate that the substrate "has a residue on its surface and a detachment profile," yet the claimed "residue" is (or at least includes) a part of the detachment profile, based on the written description:

The examiner recommends adopting claim terms "surface" and "residually projecting surface feature (i.e. residue)" as both being part of the detachment "profile," which would not introduce new matter [e.g. see the 3rd to last sentence on p. 7 of the specification].

The claim phrase "residue and a detachment profile" is objectionable since the word "and" inaccurately implies that the "residue" is not part of the "profile" resulting from "detachment."

Conceptually, the disclosed invention is directed to recycling of a non-planar substrate having a "detachment profile" [seen in Figs. 1e to 1f] that *includes* a residual projection (i.e. a residue, e.g. collar 9) projecting from a detachment "surface" (e.g. surface 8) [e.g. see the 3rd to last sentence on p. 7 of the specification]. Correction is required.

5. In claim 19, "the interface" lacks antecedent basis, yet is understood to mean an interface between the residual projection (i.e. the residue) and a surface from which the residue projects. Correction is required.

6. Claim 20 indicates that "severed" in claim 12 means "removed" since in claim 20 the residue is "removed or severed" yet in the parent claim 12, the residue is "severed."

Consequently, "sever" is being considered as synonymous with "remove," in the pending claims, for purposes of examination.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention:

The terms "substantially equivalent" and "substantially uniform planar" in independent claim 1 are relative terms, which render the claims indefinite.

The term "substantially" is not defined by the claims, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention:

"substantially equivalent"

Applicant's claimed "removing" of the "residue" is understandably ideally an exacting removal of "collar 9," and just "collar 9," for example, to get a level of removal of the collar to be "exactly equivalent" to the level of detachment surface 8.

However, the claims are ambiguous as to how much extra substrate can be removed for the "collar 9" to be considered as having been removed to a level that is "substantially equivalent" to the planar detachment surface 8. A little overshoot of removal of substrate 1', for example, seems to be included in "removing" to be "substantially equivalent," so the examiner is not sure how much substrate removal could be included in the scope of the claimed removing of the claimed residue.

For purposes of examination, a removal of a residual topographical projection from a surface (i.e. a removal of a "residue") to a level "substantially equivalent" to that of the surface is considered to include any removal of the residual projection that minimizes substrate removal below the "surface," to any degree.

"substantially uniform planar"

How uniform and planar is "substantially uniform planar"? Based on the specification, the examiner is unable to determine the scope of this claimed degree of uniformity after removal of "a residue" (i.e. a projection from a surface).

For purposes of examination, any planar action of "removal" of a "collar" or "step" or other "residual topography" (i.e. residue), is considered to result in a "substantially uniform planar surface."

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1, 12, 24, 25 and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 11-297583 (1999) to Kuwabara et al..

Regarding claim 1, the '583 reference to Kuwabara et al. discloses a method for recycling (i.e. "reusing") a substrate (i.e. a "wafer") resulting from an ion implantation process (i.e. "a hydrogen-peeling method") comprising: removing a residue (i.e. the "steps on the periphery"), shown as removed to a level "substantially equivalent" to that of the detachment profile (11) to obtain a "substantially uniform planar surface" on the substrate [Fig E on cover]; and polishing the entire surface of the substrate (i.e. "finish polishing" which inherently eliminates defects and prepares the surface in condition for molecular bonding to another substrate by the meaning of "reusing a peeled wafer").

Regarding claim 12, since "severed" is considered as being synonymous with "removed" (per item 6 above), the residual projection is "severed" (i.e. abraded, cut off, and removed by polishing).

Regarding claim 24, the polishing causes piecewise removal by abrasion, "a removal" being interpreted as synonymous with "a severing," per item 6 above.

Regarding claim 25, the '583 directs one to planarize the surface with a first "polishing to remove steps (i.e. residue)" and a second "finish polishing" after the first polishing that removes the steps, wherein the "finish polishing" inherently places the surface "in condition for bonding to another semiconductor substrate."

Regarding claim 27, the planarizing of the substrate is summarized in the "Solution" section wherein there is no heat treatment needed or suggested as part of the two-step polishing.

10. Claims 1, 5, 12, 24, 25 and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by WO 01/41218 to Kuwabara et al. (with US 6,596,610 relied on as an English language equivalent).

Regarding claim 1, looking to the cover figure of WO 01/41218 A1, the Kuwabara et al. reference discloses a method for recycling a substrate (i.e. recycling a separated wafer) that has a residue on its surface (i.e. projection of 9 and 3 above 11 in step 4 of the cover figure) and a detachment profile resulting from an ion implantation process (4) comprising: removing the residue from the substrate to a level substantially equivalent to that of the detachment profile to obtain a substantially uniform planar surface on the substrate (transition from step 4 to step 5 of the cover figure); and polishing the entire

surface of the substrate [abstract], which inherently eliminates defects and prepares the surface in condition for molecular bonding to another substrate, by the meaning of "recycling" a "separated wafer" that is a "byproduct in producing a bond wafer by ion implantation separation" per the abstract.

Regarding claim 5, at step 4 of the cover figure, the oxide portion of the residue 3 and the substrate portion of the residue 9 for a residually projecting surface feature that the reference teaches to chemically "etch" and then "polish," wherein the "etch" is a chemical attack.

Regarding claim 12, the residue of substrate and oxide is severed to form 2 uniform planar surfaces (i.e. the top and the slanted edge planar surface), as seen in steps 5 and 6 of the cover figure.

Regarding claim 24, residue 13 is severed in a piecewise manner, as seen by fragments 13 of the cover figure.

Regarding claim 25, the wafer is to be recycled, and the wafer is "polished" after being severed from its residue. The "polished" teaching is a inherent teaching of "planarizing the entire surface of the substrate after removal of the residue so that the surface is in a condition for bonding to another semiconductor substrate," by the meaning of a "separated wafer" being "recycled at high yield" [abstract].

Regarding claim 27, the method of recycling includes planarizing that does not have a required heat treatment since the method is summarized by the abstract and indicates "heat treatment and polishing" only as an "alternative," not a requirement.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 1-3, 12, 20 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,221,774 to Malik in view of US 6,846,718 to Aga et al..

Regarding claims 1-3, Malik discloses recycling a donor substrate that has a ridge at a perimeter (which is a detachment profile resulting from an ion implantation delamination process per admitted prior art of the "Background," for example), wherein the ridge (i.e. "residue") is removed by polishing with mechanical pressure at an angle [e.g. see claim 32 taken with cover figure].

While Malik speaks of touch polishing, there is no direction that a donor substrate must be polished before reuse or that there is a need for "polishing the entire surface of the substrate to eliminate defects and to prepare the surface in condition for molecular bonding to another substrate," as claimed.

Yet Aga et al. explain that "when the [donor] wafer after delamination is recycled as a [donor] wafer, the delaminated plane must be polished before use" [col. 8, lines 19-35]. Thus, Aga et al. discloses an implicit teaching that the entire surface of the donor substrate "must" be polished "to eliminate defects and to prepare the surface in condition for molecular bonding to another substrate," by the meaning of "recycled" donor (i.e. "bond") wafer.

It would have been obvious to one of ordinary skill in the art at the time of the claimed invention to touch polish a donor wafer of claim 32 of Malik after removing a projecting residue 108, motivated by the need explained by Aga et al., wherein a polishing "must" be done for repeating bonding with a recycled donor wafer, and the touch polishing that "must" be performed inherently "eliminates defects and prepares the surface in condition for molecular bonding to another substrate," when the substrate is a bond (i.e. donor) wafer needing to be "recycled."

Regarding claims 12 and 20, the meaning of "sever" is interpreted as being equivalent to "remove or sever" (based on claim 20 per item 6 above), wherein the substrate is rotated to remove a step (i.e. "residue" 108) as seen on the cover wherein an arrow shows rotation to locally polish an edge.

Regarding claim 26, the references are silent about "thinning the surface by about 0.1 to 0.3 microns during planarizing." Yet, Aga et al. explain: "when the bond wafer after the delamination is recycled as a bond wafer, the delaminated plane must be polished before use" [col. 8, lines 19-35].

Since polishing "must" be done to smooth the delamination surface plane, the polishing necessarily causes the substrate to be thinned at least as much as on the order of the delamination surface roughness, motivated to get a mirror smooth surface:

It would have been obvious to one of ordinary skill in the art to thin the (delaminated) surface as part of polishing the delamination plane per Aga et al. (i.e. "finish polishing" in Kuwabara '583). One of ordinary skill in the art would have been motivated to remove "about 0.1. to 0.3 microns during planarizing" in order to smooth out surface roughness on the order of 0.1 to 0.3 microns, for example.

When the prior art polishes to smooth, there is often a silent numerical value of thickness of thinned material (polished away). Yet, the courts have held that changing a numerical value of the prior art is not patentable unless an unexpected result can be demonstrated [MPEP 2144.05], wherein there is nothing unexpected about the depth of "finish polishing" in Kuwabara et al. being "0.1 to 0.3 um," for example.

13. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Malik in view of Aga et al., or Kuwabara et al., as applied to claim 2 above, and further in view of US 5,152,168 to Barlocchi et al..

The references to Malik, Aga et al., and Kuwabara et al. are silent about "controlling removal of the residue with a mechanical profilometer."

Barlocci et al. describes the "extremely simple use" of a "common stylus-type mechanical profilometer" to measure elevation of projections from a surface of a wafer.

In recycling a delaminated wafer such as described in the references to Malik, Aga et al., and Kuwabara et al., a step portion of the delamination profile (i.e. the "collar" or "residue" of the detachment profile) is "removed," but the references do not disclose how the removal is verified or controlled by measurement.

It would have been obvious to one of ordinary skill in the art at the time of the claimed invention to adopt the use of a mechanical profilometer to measure the step (i.e. residue) being removed (and hence "control" removal) since the step (i.e. "residue" is an elevated feature of the wafer that can be easily measured "with the use of a common stylus-type mechanical profilometer." [col. 1, lines 51-65 of Barlocci et al.].

Allowable Subject Matter

14. Claims 6-11, 13-19 and 21-23 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

15. The following is a statement of reasons for the indication of allowable subject matter:

The prior art does not disclose a method of recycling a substrate that includes removing a residual projection deemed "residue" (resulting from an ion delamination process) such that: 1) the residual projection is removed including covering a region on the detachment surface with a protective layer (e.g. claims 6-8), 2) a local ion attack removes the residual projection (e.g. claims 9-11), 3) a laser severs the residual projection (e.g. 13-16), 4) a jet stream of water, air or fluid severs the residual projection (e.g. claims 17-19), 5) a shock wave severs the residual projection (e.g. claim 21), and/or 6) ion bombardment removes the residual projection (e.g. claims 22-23).

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 6,815,309 to Letertre et al. is cited for cols. 1-2, which provide a good summary of background to the process that creates a substrate with a residually projecting feature (i.e. a residue).

US 6,312,797 to Yokokawa et al. is cited for disclosing that "touch polishing" is an alternative to "heat treatment" [col. 5]. For recycling (i.e. reclaiming), residue of oxide 3 is removed from the separated wafer 2, but is stripped off so as not to be removed to a level substantially equivalent to that of the detachment profile [col. 5, lines 42-45].

US 5,710,057 discloses a seed wafer (11) that is reused after projections (i.e. residue) between trenches (14) are removed, and discloses that "a polishing step is required to smooth the cleaved SOI surface" in the SMART-CUT process [col. 2, lines 13-23], where others have since taught that a heat treatment can be used in place of the required polishing.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Evan Pert whose telephone number is 571-272-1969. The examiner can normally be reached on M-F (7:30AM-3:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ETP
April 27, 2005

EVAN PERT
PRIMARY EXAMINER